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HORIZONTAL DISTRIBUTION OF THE DOPA-POSITIVE MELANOCYTES IN THE NAIL MATRIX*

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ABSTRACT

Horizontal distribution of dopa-positive melanocytes in the normal nail matrix was studied. The number of the dopa-positive melanocytes was approximately 300 per square millimeter in the distal areas of the intermediate nail matrix. It was not possible to estimate melanocytes in proximal areas because the melanocytes of the latter areas were obscure and much weaker in dopa reaction.

It is well known that nail pigmentation occurs in some conditions (1–3). However, the melanocytes of the nail matrix have received little attention in dermatological textbooks and literature (4–6). One of the authors has recently reported that dopa-positive melanocytes were present even in the normal nail matrix of Japanese newborns (7). This is a report of further studies of the melanocytes of the nail matrix.

MATERIALS AND METHODS

Fourteen normal distal phalanges and nails were taken at autopsy from Japanese subjects.

The staining procedure for sheets of the nail matrix was as follows: 1) Remove the nail plate, the bone and the surrounding tissues. 2) Immerse the specimen in a 2 N solution of sodium bromide at room temperature for 3 to 4 hours. 3) Remove the nail matrix by gentle tearing. 4) Incubate the separated sheet of the nail matrix in buffered dopa solution at 37° C for 14 hours.

The stained sheets were mounted in gelatin-glycerol without dehydration. An ocular micrometer was used for counting. The number of dopa-positive melanocytes was counted in 5 square fields with a side length of 500 μ in each specimen, and their number per square millimeter was calculated by conversion. The area of the pericaryon of the dopa-positive cells was calculated by multiplying the shortest and the longest diameters between the points of origin of dendrites. Counting the number and calculating the area in dopa-positive melanocytes were carried out only in the distal third of the intermediate nail matrix.

RESULTS

A large number of dopa-positive melanocytes which generally possess two polar branches along the longitudinal axis of the nail are present in the distal areas of the intermediate nail matrix, but very few in the proximal areas. Interestingly, the dermal ridges of the nail matrix are found to parallel the longitudinal axis of the nail in the former areas, although it is true that the matrix ridges are arboreal in the latter areas (8) (Fig. 1). The intensity of dopa reaction of the cells apparently tends to decrease in the proximal areas. The entire volume of perikaryons in the distal areas is stained black, while that in the proximal areas is stained brown without staining of the nucleus. The dopa-positive melanocytes in the distal areas are larger and more dendritic than those in the proximal areas (Figs. 2 and 3).

The number of dopa-positive melanocytes varies from a minimum of 208 cells per square millimeter to a maximum of 576 in the distal portion of the nail matrix (Table I). The size of perikaryons varies from the largest of 300 μ^2 to the smallest of 50 μ^2 (Table II). The longest dendrite is above 60 μ.

DISCUSSION

The distribution and number of dopa-positive melanocytes in the nail matrix differ from those in the normal epidermis. The topographical distribution of dopa-positive melanocytes is greater in number at the epidermal ridges than the valleys in the normal skin (9), while there are no more dopa-positive melanocytes on the matrix ridges than in between in the distal areas of the nail matrix. This feature may be ascribed to the lack of epidermal appendages. It is commonly believed that the melanocytes are dopa-positive in the normal glabrous skin, but there is a marked difference in intensity of dopa reaction of the cells in the nail matrix. In the proximal areas of matrix the dopa-positive

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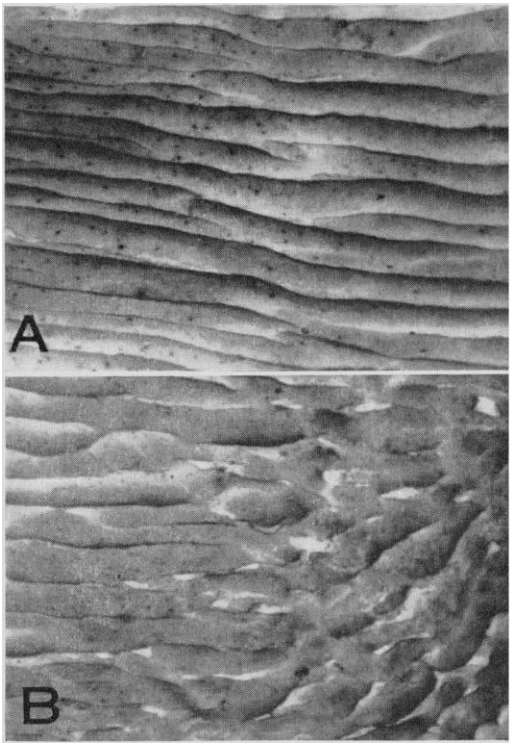

FIG. 1. Separated sheet of the nail matrix (dopa reaction, × 68) (a) Distal area, (b) Proximal area. The dopa reaction of melanocytes is gradually decreased in intensity from the distal to the proximal area in the intermediate nail matrix. Also, note the parallel pattern of the matrix ridges in (a) and the arboreal pattern in (b).

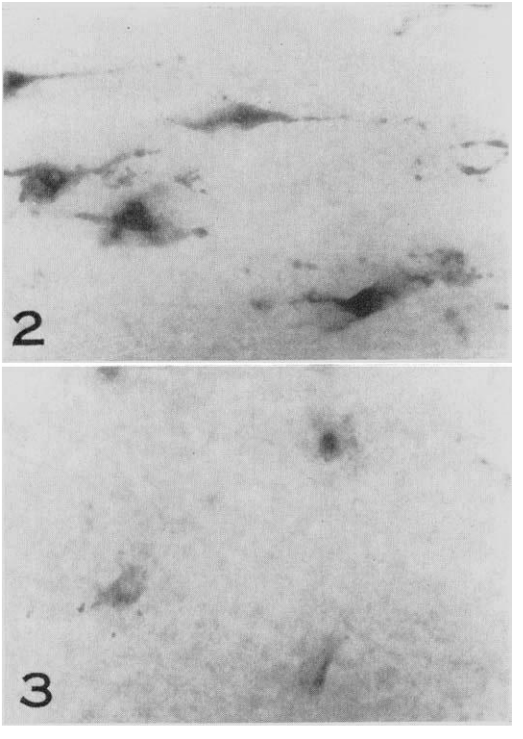

FIG. 2. Dopa-positive melanocytes in the distal area of the intermediate nail matrix (dopa reaction, × 625). The cytoplasm of the melanocytes is stained black by the dopa reaction and the dendrites extend along the longitudinal axis of the nail.

FIG. 3. Dopa-positive melanocytes in the proximal area of the intermediate nail matrix (dopa reaction, × 625). The cytoplasm of the melanocytes is stained light brown but dendrites are not seen with the dopa reaction.

TABLE I

Number of dopa-positive melanocytes per square millimeter in the distal area of the intermediate nail matrix

Materials	Number of melanocytes	Materials	Number of melanocytes
New born		Adult	
Thumb	350/mm²	Middle finger	252/mm²
Middle finger	350	Index finger	440
Big toe	275	Index finger	268
Big toe	250	Big toe	576
Adult		Big toe	320
Thumb	448	II toe	208
Thumb	320	II toe	232
Middle finger	384		
	Mean	334 ± 98/mm²	

TABLE II

The size of the pericaryon of the melanocytes in the nail matrix

Size*	Number	Size*	Number
25–50 μ^2	9	176–200	3
51–75	13	201–225	3
76–100	22	226–250	5
101–125	18	251–275	0
126–150	23	276–300	1
151–175	3	Total	100

Mean value of the size: 123.6 μ^2

* The size value of the pericaryon was expressed by multiplying the shortest and the longest diameter in each of the dopa-positive cells.

melanocytes are apparently much fewer and more obscure than in the distal areas.

The melanocyte count in normal epidermis was reported to be 500 to 4,500 per square mm by Szabo (9), and 400 to 2,784 by Staricco and Pinkus (10), while it ranged from 208 to 576 in the distal areas of the intermediate nail matrix. The nail matrix is covered by the nail plate, and additionally covered by the nail fold at the proximal areas. Thus, the melanocytes of the nail matrix are presumed not to be stimulated with ultraviolet light or other external agents. This could be the reason why the population of dopa-positive melanocytes is smaller in the nail matrix than in the glabrous skin, and also smaller in the proximal areas of the nail matrix than in the distal areas, although it seems very likely that the entire melanocyte population is approximately the same everywhere in the nail matrix.

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